

Claims

1. A method of growing cadmium mercury telluride, $\text{Hg}_{1-x}\text{Cd}_x\text{Te}$ where x is $0 \leq x \leq 1$, comprising the steps of;
- 5 a) taking a crystalline substrate,
- b) growing at least one buffer layer on said substrate by molecular beam epitaxy, and
- 10 c) growing at least one layer of cadmium mercury telluride on said at least one buffer layer by metal-organic vapour phase epitaxy.
2. A method as claimed in claim 1 wherein the substrate is chosen from the group consisting of cadmium telluride, zinc telluride, cadmium zinc telluride, gallium arsenide, silicon, germanium, indium antimonide, indium aluminium antimonide, indium gallium antimonide, indium phosphide, sapphire, cadmium zinc selenide, cadmium zinc selenide telluride, alumina or spinel.
- 15 20 3. A method as claimed in claim 2 wherein the substrate is silicon.
4. A method as claimed in any preceding claim wherein the step of taking a crystalline substrate includes arranging said substrate to be mis-aligned from the form $\{100\}$ in either the $\langle 111 \rangle$ or $\langle 110 \rangle$ directions.
- 25 5. A method as claimed in claim 4 wherein the degree of mis-alignment of the substrate is between 1° and 10° .
- 30 6. A method as claimed in any preceding claim wherein the substrate is silicon and wherein said silicon substrate orientation is (001) mis-aligned towards the $[111]$ direction

7. A method as claimed in any previous claim wherein the step of growing at least one buffer layer by molecular beam epitaxy comprises the step of growing one or more layers chosen from zinc telluride, cadmium telluride and cadmium zinc telluride.
8. A method as claimed in any preceding claim wherein the step of growing at least one buffer layer by molecular beam epitaxy comprises the step of growing a layer of zinc telluride on the substrate and growing a layer of cadmium telluride on said zinc telluride layer.
9. A method as claimed in any preceding claim further comprising the step, prior to the step of growing the at least one layer of cadmium mercury telluride, of cleaning the surface of the uppermost buffer layer grown by molecular beam epitaxy.
10. A method as claimed in any preceding claims wherein the method further comprises the step, after growing at least one buffer layer by molecular beam epitaxy, of growing at least one buffer layer by metal organic vapour phase epitaxy.
11. A method as claimed in claim 10 wherein at least one buffer layer grown by metal organic vapour phase epitaxy step is the same as a buffer layer grown by molecular beam epitaxy.
12. A method as claimed in claim 11 wherein the step of growing at least one buffer layer by molecular beam epitaxy comprises growing a top layer of cadmium telluride on a base layer zinc telluride on the substrate the step of growing at least one further buffer layer comprises growing a further cadmium telluride layer by metal organic vapour phase epitaxy.
13. A method as claimed in any preceding claim wherein the step of growing the at least one cadmium mercury telluride layer comprises sequentially

growing thin layers of CdTe and HgTe which interdiffuse during growth to give a single layer of CMT, the relative thicknesses of the CdTe and HgTe layers determining the cadmium content x.

- 5 14. A method as claimed in any preceding claim wherein di-*iso*-propyltelluride is the tellurium precursor and dimethylcadmium is the cadmium precursor in the step of growing the at least one cadmium mercury telluride layer by MOVPE.
- 10 15. A method as claimed in any preceding claim wherein the step of growing the at least one cadmium mercury telluride layer involves doping at least one of the cadmium mercury telluride layers with a dopant.
- 15 16. A method according to claim 15 wherein the dopant is chosen from iodine, arsenic, indium, phosphorous and antimony.
- 20 17. A method according to any preceding claim wherein the step of growing at least one cadmium mercury telluride layer comprises the step of growing a plurality of layers of cadmium mercury telluride, at least some of the layers having a different thickness, composition, dopant and/or dopant concentration.
- 25 18. A method according to any preceding claim wherein the method further comprises the step of device processing.
- 30 19. A method according to claim 18 wherein the method comprises the step, after the device processing step, of coating the devices with at least one passivating layer.
- 30 20. A method according to claim 19 wherein the at least one passivating layer comprises cadmium telluride.

21. A method according to claim 19 or claim 20 wherein the step of coating the device with a passivating layer comprises growing at least one epitaxial layer grown by metal organic vapour phase epitaxy.
- 5 22. A method according to claim 18 wherein the method involves the step, after the device processing step, of growing further epitaxial layers of cadmium mercury telluride by metal organic vapour phase epitaxy.
- 10 23. A method producing a buffered substrate suitable for growth of at least one layer of cadmium mercury telluride by metal organic vapour phase epitaxy the method comprising the steps of taking a crystalline substrate and growing at least one buffer layer by molecular beam epitaxy.
- 15 24. A method as claimed in claim 23 wherein the substrate is mis-aligned from the {100} form towards $\langle 111 \rangle$ or $\langle 110 \rangle$.
25. A method as claimed in claim 23 or claim 24 wherein the substrate is silicon.
- 20 26. A method as claimed in claim 25 wherein the orientation of the silicon substrate is (001) mis-aligned from 1° to 10° to [111].
- 25 27. A method as claimed in any of claims 1 – 22 or as claimed in any of claims 23 – 26 further comprising the step, prior to growing at least one buffer layer by molecular beam epitaxy, of cleaning/treating the substrate.
- 30 28. A method as claimed in claim 27 wherein the step of cleaning/treating the substrate comprises the step of heating the substrate under an arsenic flux.
29. A method of manufacture of cadmium mercury telluride comprising the steps of taking a buffered substrate comprising one or more buffer layers grown on a crystalline substrate by molecular beam epitaxy and growing at

least one layer of cadmium mercury telluride by metal organic vapour phase epitaxy.

- 5 30. A method as claimed in claim 29 wherein the buffered substrate is a buffered substrate produced by the method of any of claims 23 to 28.
- 10 31. An infrared device comprising a substrate, at least one buffer layer on the substrate and at least one layer of cadmium mercury telluride on the at least one buffer layer wherein the substrate orientation is {100} mis-aligned by 1° - 10° inclusive to $\langle 110 \rangle$ or $\langle 111 \rangle$.
32. An infrared device as claimed in claim 31 wherein the substrate is silicon has an orientation (001) mis-aligned by 1° - 10° inclusive to [111].
- 15 33. An infrared device as claimed in claim 31 or claim 32 wherein the at least one buffer layer comprises one or more layer chosen from zinc telluride, cadmium telluride and cadmium zinc telluride.
- 20 34. An infrared device comprising a substrate, at least one buffer layer formed on the substrate and at least one layer of cadmium mercury telluride formed on the at least one buffer layer wherein the at least one layer of cadmium mercury telluride is tuned to be active at long wave infrared wavelength radiation and wherein the substrate is silicon.
- 25 35. An infrared device as claimed in any of claims 31 to 34 wherein the device is a detector.
36. An infrared device as claimed in any of claims 31 to 34 wherein the device is an infrared source.
- 30 37. A method of growing at least one crystalline layer of $\text{Hg}_{1-x}\text{Cd}_x\text{Te}$ where $0 \leq x \leq 1$ comprising the step of taking a substrate having at least one mesa device formed in at least one layer of cadmium mercury telluride and

growing said at least one layer of $\text{Hg}_{1-x}\text{Cd}_x\text{Te}$ by metal organic vapour phase epitaxy.